

CONFERENCE ON EARLY MARS:
Geologic and Hydrologic Evolution,
Physical and Chemical Environments,
and the Implications for Life
April 24–27, 1997

PRELIMINARY PROGRAM

To navigate between the program and abstracts: Using the grab-hand tool from your tool bar, move your cursor over the title of the abstract you wish to view. If an abstract is available, the grab-hand will change to a closed fist with the index finger pointing upward. For your convenience, the names of authors who submitted abstracts are underlined in the program. (All titles listed under Poster Sessions and Title-Only Abstracts have accompanying abstracts.) You can use the arrows on your tool bar to navigate back and forth between the abstracts and the program.

Wednesday evening, April 23, 1997

6:00–8:30 p.m.

EARLY REGISTRATION

Thursday morning, April 24, 1997

7:30–8:30 a.m.

REGISTRATION AND CONTINENTAL BREAKFAST

8:30–8:45 a.m.

WELCOME AND OPENING REMARKS

REVIEW OF DAY'S AGENDA AND KEY QUESTIONS

8:30–11:05 a.m.

EARLY EARTH AND THE ORIGIN OF LIFE
Moderator: M. J. Drake

Hoffman P.*

Geologic Evolution of the Early Earth

Holland H.*

Atmospheric and Hydrologic Evolution of the Early Earth

Chang S.*

The Origin of Life on Earth

MODERATED GENERAL DISCUSSION

BREAK

* Denotes speaker

Thursday morning, April 24, 1997

11:05 a.m.–12:30 p.m.

EARLY MARS: PHYSICAL ENVIRONMENT

Moderator: M. H. Carr

Drake M.*

Accretion of Earth and Mars: Implications for Bulk Composition and Volatile Inventories

Vickery A.*

Effects of Cratering on the Early History of Mars

Schubert G.*

Geothermal and Volcanic Evolution of Early Mars

LUNCH

Thursday afternoon, April 24, 1997

2:00–3:30 p.m.

EARLY MARS: PHYSICAL ENVIRONMENT (continued)

Moderator: M. H. Carr

Haberle R.*

Mars: Evolution of the Early Atmosphere and Climate

Clifford S.*

Hydrologic Considerations in the Evolution of a Cold vs. Warm Early Mars

MODERATED GENERAL DISCUSSION

BREAK

Thursday afternoon, April 24, 1997

3:45–6:00 p.m.

FORMAL DEBATE:

WAS THE EARLY MARTIAN CLIMATE WARM OR COLD?

Moderator: S. W. Squyres

Cold Team: M. H. Carr, J. F. Kasting, V. C. Gulick

Warm Team: T. J. Parker, B. M. Jakosky, A. D. Howard

MODERATED GENERAL DISCUSSION

Thursday evening, April 24, 1997

6:00–8:00 p.m.

RECEPTION AND POSTER SESSION I

Authors and titles for both poster sessions are listed at the end of this program.

Friday morning, April 25, 1997

8:00–8:30 a.m.

REGISTRATION AND CONTINENTAL BREAKFAST

8:30–8:45 a.m.

REVIEW OF DAY'S AGENDA AND KEY QUESTIONS

8:45–10:30 a.m.

PANEL DISCUSSION:

THE PHYSICAL ENVIRONMENT OF THE EARLY EARTH AND MARS:

A CRITICAL ASSESSMENT

Moderator: J. R. Zimbelman

Panelists

V. R. Baker, F. P. Fanale, H. D. Holland, T. Maxwell, G. E. McGill, K. L. Tanaka

BREAK

Friday morning, April 25, 1997

10:30 a.m.–12:00 noon

EARLY MARS: CHEMICAL AND MINERALOGICAL ENVIRONMENTS

Moderators: A. H. Trieman and H. E. Newsom

Trieman A.*

What is Mars' Highland Crust?

Gooding J.*

Geochemical Evolution of the Crust of Mars

Griffith L.*

Aqueous Geochemistry and Groundwater-Crustal Interactions

LUNCH

Friday afternoon, April 25, 1997

2:00–4:15 p.m.

EARLY MARS: CHEMICAL AND MINERALOGICAL ENVIRONMENTS (continued)

Moderators: A. H. Trieman and H. E. Newsom

Newsom H.*

Hydrothermal Environments and Chemical Transport on Mars

Clark B.*

Geochemical Cycles of CHNOPS and Other Potentially Important Biological Elements on Mars

Clark R.*

Instrumental Detection of Diagnostic Minerals

BREAK

Chyba C.*

Sources and Fate of Martian Organics

Friday afternoon, April 25, 1997

4:15–5:45 p.m.

**FOCUSED DISCUSSION:
ENVIRONMENTAL CONDITIONS AND CHALLENGES FOR EARLY MARTIAN LIFE**
Moderator: J. D. Farmer

Saturday morning, April 26, 1997

8:00–8:30 a.m.

REGISTRATION AND CONTINENTAL BREAKFAST

8:30–8:45 a.m.

REVIEW OF DAY'S AGENDA AND KEY QUESTIONS

8:45 a.m.–12:30 p.m.

LIFE IN EXTREME ENVIRONMENTS
Moderator: K. H. Nealson

Pierson B.*

Photoautotrophy in Extreme Environments: Sulfide, Iron, Salinity, and Ultraviolet Radiation

Litchfield C.*

Living in High Salt: The Extreme Halophiles

Friedmann I.*

The Endolithic Microbial Habitat

BREAK

Stevens T.*

Microorganisms in the Deep Terrestrial Subsurface: Evidence for In Situ Primary Production

Reysenbach A.-L.*

Biodiversity at High Temperatures: Exploring the Deepest Branches of the Tree of Life

MODERATED GENERAL DISCUSSION

LUNCH

Saturday afternoon, April 26, 1997

2:00–3:30 p.m.

LIFE ON MARS
Moderator: D. J. Des Marais

Farmer J.*

Exopalaeontology and the Search for a Fossil Record on Mars

Melosh J.*

Mars Meteorite and Panspermian Possibilities

MODERATED GENERAL DISCUSSION

BREAK

Saturday afternoon, April 26, 1997

3:45–5:45 p.m.

**OPEN DISCUSSION:
OTHER VIEWS OF EARLY MARS**
Moderators: S. M. Clifford and J. F. Kasting

*Open discussion about early geology, hydrology, climate, and life
(order and emphasis to be determined by a poll of conference participants prior to Saturday's lunch break).*

**PANEL DISCUSSION:
THE FUTURE OF MARS EXPLORATION**
Moderator: TBD

Panelists
A. L. Albee, M. P. Golombek, M. A. Meyer, TBD

Saturday evening, April 26, 1997

5:45–8:00 p.m.

POSTER SESSION II

Authors and titles for both poster sessions are listed at the end of this program.

Sunday morning, April 27, 1997

8:00–8:30 a.m.

REGISTRATION AND CONTINENTAL BREAKFAST

8:30–8:45 a.m.

REVIEW OF DAY'S AGENDA AND KEY QUESTIONS

8:45–10:45 a.m.

LIFE IN MARTIAN METEORITES
Moderator: D. Morrison

FORMAL DEBATE

The Case For: D. S. McKay, E. K. Gibson Jr., K. Thomas-Keprta, C. S. Romanek
The Case Against: K. H. Nealson, L. Becker, G. D. McDonald, R. P. Harvey

BREAK

Sunday morning, April 27, 1997

11:00 a.m.–12:00 noon

LIFE IN MARTIAN METEORITES (continued)
Moderator: D. Morrison

MODERATED GENERAL DISCUSSION

Sunday afternoon, April 27, 1997

12:00 noon–1:30 p.m.

SUMMARY PANEL DISCUSSION

Moderators: S. M. Clifford, A. H. Treiman, H. E. Newsom, and J. D. Farmer

Critique of meeting, review of key questions, needed observations, and recommendations for future missions.

Panelists

M. H. Carr, B. C. Clark, P. Hoffman, S. Chang, and R. M. Haberle

CONFERENCE ADJOURNS

Sunday afternoon, April 27, 1997

1:45–2:15 p.m.

PRESS CONFERENCE

See next three pages for listings of poster sessions and title-only abstracts.

POSTER SESSION I
Thursday evening, April 24, 1997
6:00–8:00 p.m.

Barlow N. G.

Effect of Impacts on Early Martian Geologic Evolution

Bish D. Vaniman D. Sarrazin P. Blake D. Chipera S. Collins S. A. Elliott T.

Application of the CHEMIN XRD/XRF Instrument in Analyzing Diagnostic Mineralogies: Quantitative XRD Analysis of Aragonite and Basalt

Bishop J. L. Friedl J. Schwertmann U.

Spectroscopic Identification of Minerals in Hematite-bearing Soils and Sediments: Implications for Chemistry and Mineralogy of the Martian Surface

Boynton W. V. Feldman W. C. Squyres S. W. Trombka J. I. Arnold J. R. Englert P. A. J. Metzger A. E. Reedy R. C. Wänke H. Bailey S. H. Brückner J. Evans L. G. McSween H. Y. Starr R.

Scientific Issues Addressed by the Mars Surveyor 2001 Gamma-Ray/Neutron Spectrometer (GRS/NS)

Bullock M. A. Moore J. M. Mellon M. T.

Experimental Studies of Mars-Analog Brines

Cabrol N. A. Grin E. A.

Hydrogeology and Exobiology Significance of Martian Large Crater Lakes

Calvin W. M. Treiman A. H. Kirkland L.

The Highlands Crust of Mars and the Pathfinder Mission: A Prospective View from Mariner 6 Infrared Spectroscopy

Chassefière E.

Thermal Loss of Water on Young Planets: The Effect of a Strong Primitive Solar Wind

Craddock R. A. Maxwell T. A. Howard A. D.

The Early History of Mars as Told by Degraded Highland Impact Craters

Crisp D. Pierrehumbert R. T.

The Radiative Effects of CO₂ Ice Clouds on the Early Martian Climate

Crown D. A. Mest S. C. Stewart K. H.

Degradation of the Martian Cratered Highlands: The Role of Circum-Hellas Outflow Channels and Constraints on the Timing of Volatile-driven Activity

Dreibus G. Wänke H. Lugmair G. W.

Volatile Inventories of Mars and Earth and Their Implication for the Evolution of Planetary Atmospheres

Edgett K. S. Parker T. J.

Regarding a Wet, Early Noachian Mars: Geomorphology of Western Arabia and Northern Sinus Meridiani

Forsythe R. D. Blackwelder C. R.

Highland Crater Basins as Evaporative/Sublimative Discharge Pumps for Driving Early Martian Groundwater to Atmosphere Water Transfers

Hutchins K. S. Jakosky B. M.

Role of the Crust in the Evolution of the Martian Atmosphere

Kuramoto K. Matsui T.

Chemistry of Carbon, Hydrogen, and Oxygen During Early Martian Differentiation

Lee P.

A Unique Mars/Early Mars Analog on Earth: The Haughton Impact Structure, Devon Island, Canadian Arctic

Lucchitta B. K.

Ice in Channels and Ice-Rock Mixtures in Valleys on Mars: Did They Slide on Deformable Rubble Like Antarctic Ice Streams?

McGill G. E. Carruthers M. W.

Evidence for Volcanism Associated with Ismeniae Fossae Fretted Channels

Morris R. V. Golden D. C.

Goldenrod Pigment and the Occurrence of Hematite and Goethite on the Martian Surface

Morris R. V. Klingelhöfer G.
Mössbauer Mineralogy on Mars

Newsom H. E. Hagerty J. J.
Composition of the Martian Soil

Parker T. J.
Fluvial and Lacustrine Degradation of Large Martian Basins During the Noachian

Pérez-de-Tejada H.
Solar-Wind-induced Erosion of the Mars Atmosphere

Rice J. W. Jr.
Elysium Basin, Mars: An Intermittent or Perennial Lake from Noachian to Amazonian Time

Sumner D. Y.
Carbonate Precipitation in Anoxic Environments: Implications for Atmospheric CO₂ Removal on Early Mars

Swindle T. D. Kring D. A.
Studies of Weathering Products in the Lafayette Meteorite: Implications for the Distribution of Water on Both Early and Recent Mars

Tanaka K. L. Dohm J. M. Hare T. M.
Distribution of Channels in the Thaumasia Region Indicates Hydrologic Activity Largely Due to Local Heating During Early Mars

Vlassopoulos D.
Subsurface Fluid Reservoirs on Mars: A Possible Explanation for the Fate of an Early Greenhouse Atmosphere

POSTER SESSION II
Saturday evening, April 26, 1997
5:45–8:00 p.m.

Agresti D. G. Wdowiak T. J. Wade M. L. Armendarez L. P. Farmer J. D.
Mössbauer Spectroscopy of Thermal Springs Iron Deposits as Martian Analogs

Allen C. C. Morris R. V. Golden D. C. Upchurch C. S.
Geologic Alteration and Life in an Extreme Environment: Pu'u Waiau, Mauna Kea, Hawaii

Becker L. McDonald G. D. Bada J. L.
Biomarkers for Analysis of Martian Samples

Bogard D. D. Garrison D. H.
³⁹Ar-⁴⁰Ar Age of Allan Hills 84001

Cady S. L. Blank C. E. Des Marais D. J. Walter M. R. Farmer J. D.
Microbial Diversity in Hyperthermophilic Biofilms: Implications for Recognizing Biogenicity in Hydrothermal Deposits

Doran P. T. Wharton R. A.
Mars on Earth: Antarctic Dry Valley Lakes and Their Deposits

Edgett K. S. Rice J. W. Jr.
Geologic Signature of Life on Mars: Low-Albedo Lava Flows and the Search for "Warm Havens"

Farmer J. D. Cady S. L. Des Marais D. J. Walter M. R.
Fossilization Processes in Modern Thermal Springs: Clues for Assessing the Biogenicity of Ancient Hydrothermal Deposits

Fisler D. K. Cygan R. T. Westrich H. R.
Cation Diffusion in Carbonate Minerals: Determining Closure Temperatures and the Thermal History for the Allan Hills 84001 Meteorite

Flynn G. J.
Organic Matter Contributed to the Surface of Mars by Interplanetary Dust, Meteorites, Comets, and Asteroids

Gilmour J. D. Wogelius R. A. Grime G. W. Turner G.
Major- and Trace-Element Distributions in Allan Hills 84001 Carbonate: Indication of a High Formation Temperature

Hofmann B. A. Farmer J. D.
Microbial Fossils from Terrestrial Subsurface Hydrothermal Environments: Examples and Implications for Mars

* Denotes speaker

Jagoutz E.

Why the SNC Meteorites Might Not Come from Mars

Knudsen J. M. Gunnlaugsson H. P. Madsen M. B. Hviid S. F. Goetz W.

The Magnetic Properties Experiment on Mars Pathfinder

Kring D. A. Swindle T. D. Gleason J. D. Grier J. A.

Relative Ages of Maskelynite and Carbonate in Allan Hills 84001 and Implications for Early Hydrothermal Activity on Mars

Lane M. D. Christensen P. R.

Thermal Emission Spectroscopy of Aqueously Precipitated Minerals Similar to Those in the SNCs

Miura Y.

Active Carbohydrate Oligomers of Bacteria in Anoxic Environments

Miura Y.

Chemical Evolution by Shock-Wave Energy in Anoxic Atmospheres

Nyquist L. E. Borg L. E. Shih C.-Y.

The Shergottite Age Paradox

Saxton J. M. Lyon I. C. Turner G.

Oxygen Isotope Ratio Zoning in Allan Hills 84001 Carbonates

Sheldon W. R.

Implications of Martian Life in an Antarctic Meteorite

Taunton A. E.

SEM Studies of Antarctic Lunar and SNC Meteorites with Implications for Martian Nanofossils: A Progress Report

Wadhwa M. Lugmair G. W.

The Controversy of Young vs. Old Age of Formation of Carbonates in Allan Hills 84001

Wdowiak T. J. Agresti D. G. Mirov S. B. Kudryavtsev A. B. Beagle L. W. Des Marais D. J. Tharpe A. F.

Identification of Ancient Carbonaceous Cherts on Mars Using Raman Spectroscopy

Wdowiak T. J. Agresti D. G. Mirov S. B. Kudryavtsev A. B. Kinney T. R.

Progress in the Development of a Laser Raman Spectrometer System for a Lander Spacecraft

Westall F.

The Nature of Fossil Bacteria

Wright I. P. Assanov S. Verchovsky A. B. Franchi I. A. Grady M. M. Pillinger C. T.

Further Investigation of Isotopically Light Carbon in Allan Hills 84001

TITLE-ONLY ABSTRACTS

Banin A. Mancinelli R. L.

Developing a Chemical Code to Identify Magnetic Biominerals (Biomagnetite and Biogreigite) in Mars Soil and Rocks

Clifford S. M.

Hydraulic and Thermal Constraints on the Development of the Martian Valley Networks

Clifford S. M.

The Origin of the Martian Intercrater Plains: The Role of Liquefaction from Impact and Tectonic-induced Seismicity

Gibson E. K. Jr. McKay D. S. Thomas-Keprta K. Romanek C. S. Clemett S. J. Zare R. N.

Biogenic Activity in Martian Meteorite Allan Hills 84001: Status of the Studies

Mustard J. F.

Chemical and Mineralogical Processes in Martian Soils

Rice J. W. Jr.

Getting the First Crack at Noachian Clasts and Sediments: A Pathfinder's Prospectus

Wilson L. Head J. W. III

Mars Geothermal and Volcanic Evolution: Volcanic Intrusions as Heat Sources to Maintain Viable Ecosystems?